TEMPO AND CALAGIO: EXAMPLES OF LOOSE COUPLING FOR MULTI-MECHANICS SIMULATIONS

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The development of engineering analysis codes at Sandia National Laboratories is being accelerated by SIERRA, a computational framework that provides data storage, parallel, and I/O services. SIERRA also provides tools to transfer data from one analysis module to another. These tools have enabled the creation of multi-mechanics analysis codes such as Tempo, a coupled quasistatics and explicit dynamics code, and Calagio, a coupled thermal and quasistatics code.

Tempo is the combination of the quasistatics code Adagio and the explicit dynamics code Presto. In a simulation with Tempo, Adagio executes first, enforcing equilibrium on the system through potentially many load steps. When Adagio has completed its stage of the analysis, a transfer of data occurs. Displacement, stress, and other pertinent data calculated by Adagio are prepared for use by Presto. The final equilibrium state determined by Adagio is used as initial conditions by Presto, which calculates the dynamic response through time.

In Calagio, the thermal code Calore computes a temperature field on a body. This field is then transfered to Adagio for inclusion in thermal strain calculations. Calagio allows the deformation calculated by Adagio to transfer to Calore. Thus, by repeating this sequence, the system may converge to the solution for both temperature and deformation.

The transfer operators provided by SIERRA allow Adagio, Presto, and Calore to develop relatively independently. In particular, because the transfers are high-level operations, the SIERRA framework can pass variables between the codes without requiring any changes to the analysis code libraries. Because Tempo and Calagio are a single executables, no user intervention is required and simulations proceed automatically.

This presentation will explain some of the capabilities of Tempo and Calagio, give insight into the transfer operators, show examples of the types of problems appropriate for these codes, and give results from simulations.

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